

 <p>Financial Assistance Award</p> <p>DENALI COMMISSION 510 L Street, Suite 410 Anchorage, Alaska 99501 (907) 271-1414 (phone) (907) 271-1415 (fax) www.denali.gov</p>		Award Number	01486-01																																																																													
		Award Title	Environmentally Threatened Community Program Support																																																																													
		Performance Period	December 1, 2015 through June 30, 2018																																																																													
Authority 112 Stat 1854	CFDA Number 90.100	<u>Recipient Organization & Address</u> UNIVERSITY OF ALASKA FAIRBANKS PO BOX 757880 Alaska Center for Energy and Power Phone: 907-474-6264 Recipient DUNS # 615245164 TIN # 926000147																																																																														
Denali Commission Finance Officer Certification																																																																																
<u>Cost Share Distribution Table</u> <table border="1" style="width: 100%; border-collapse: collapse; text-align: right;"> <thead> <tr> <th rowspan="2">Accounting Code</th> <th colspan="2">New Funding</th> <th colspan="2">Prior Period Funding</th> <th rowspan="2">Total</th> </tr> <tr> <th>Denali Commission</th> <th>Other Contributors</th> <th>Denali Commission</th> <th>Other Contributors</th> </tr> </thead> <tbody> <tr> <td>95670000</td> <td>\$367,000.00</td> <td></td> <td>\$50,000.00</td> <td></td> <td>\$417,000.00</td> </tr> <tr><td></td><td>\$0.00</td><td></td><td>\$0.00</td><td></td><td>\$0.00</td></tr> <tr><td></td><td>\$0.00</td><td></td><td>\$0.00</td><td></td><td>\$0.00</td></tr> <tr><td></td><td>\$0.00</td><td></td><td>\$0.00</td><td></td><td>\$0.00</td></tr> <tr><td></td><td>\$0.00</td><td></td><td>\$0.00</td><td></td><td>\$0.00</td></tr> <tr><td></td><td></td><td>\$0.00</td><td></td><td>\$0.00</td><td>\$0.00</td></tr> <tr><td></td><td></td><td>\$0.00</td><td></td><td>\$0.00</td><td>\$0.00</td></tr> <tr><td></td><td></td><td>\$0.00</td><td></td><td>\$0.00</td><td>\$0.00</td></tr> <tr><td></td><td></td><td>\$0.00</td><td></td><td>\$0.00</td><td>\$0.00</td></tr> <tr><td></td><td></td><td>\$0.00</td><td></td><td>\$0.00</td><td>\$0.00</td></tr> <tr> <td>Total</td> <td>\$367,000.00</td> <td>\$0.00</td> <td>\$50,000.00</td> <td>\$0.00</td> <td>\$417,000.00</td> </tr> </tbody> </table>					Accounting Code	New Funding		Prior Period Funding		Total	Denali Commission	Other Contributors	Denali Commission	Other Contributors	95670000	\$367,000.00		\$50,000.00		\$417,000.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00		\$0.00			\$0.00		\$0.00	\$0.00			\$0.00		\$0.00	\$0.00			\$0.00		\$0.00	\$0.00			\$0.00		\$0.00	\$0.00			\$0.00		\$0.00	\$0.00	Total	\$367,000.00	\$0.00	\$50,000.00	\$0.00	\$417,000.00
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Signature of Authorized Official - Denali Commission Electronically Signed		Typed Name and Title Mr. Joel Neimeyer Federal Co-Chair		Date 03/27/2017																																																																												

AWARD ATTACHMENTS

UNIVERSITY OF ALASKA FAIRBANKS

01486-01

1. Terms and Conditions
2. Task Order List
3. Task Order #1- for reference
4. Task Order #2 - Including Budget Summary
5. USACE Statewide Threat Assessment Scope - for reference

***Award Conditions to the Financial Assistance Award
Between the Denali Commission and University of Alaska - Fairbanks
For Environmentally Threatened Community Program Support
Award No. 1486, Amendment 1
10 March 2017***

All changes to the award conditions are noted below.

1. Change Title of Award to “*Environmentally Threatened Community Program Support*”
2. Append Task Order List dated 10 March 2017 for reference.
3. Append Task Order #1 (completed) for reference.
4. Add scope identified as Task Order #2 dated 10 March 2017.
5. Increase funding by \$367,000
6. Add the following to Section 3 of the original award: “*At a minimum, all 270’s must include summary cost information on labor, materials, contracts/consultants, and indirect costs. Detailed documentation is required for any single expenditure greater than \$50,000.*”
7. Add the following to Section 4 of the original award: “*Recipient shall request prior approval from the Program Manager for deviations.*”
8. Replace Section 11 Denali Commission Policies of the original award with the following:

Recipients may be required to comply with certain published Denali Commission policies which can be found in the *Recipient Guidelines and Requirements* document. Applicable policies are referenced in the Special Provisions of this FAA, and specific requirements and deliverables (if any) are stipulated in the attachments to this FAA.
9. Replace Section 14, Special Provisions of the original award with the following:

Progress Reports: Shall be submitted on a quarterly basis beginning with the period April 1, 2017 to June 30, 2017, in accordance with the Commission’s *Recipient Guidelines and Requirements*.
10. Change the Denali Commission contacts in Section 15 of the original award as follows:

Program Manager

CAPT Don Antrobus, PE

Phone: 907-271-1414

E-mail: dantrobus@denali.gov

Grants Management Officer

Janet Davis

Phone: 907-271-1414

E-mail: jdavis@denali.gov

There are no other changes to the original Financial Assistance Award.

Award 1486 Task Order List

As of 10 March 2016

Task Order #	Date	Scope	Budget	Award Reference	Total Award To Date
1	10-Dec-15	ETC Charette	\$50,000	1486.00	\$50,000
2	10-Mar-16	Statewide Threat Assessment	\$367,000	1486.01	\$417,000

Financial Assistance Award 1486

Between Denali Commission and University of Alaska – Fairbanks

Task Order #1

Environmentally Threatened Community Charrette

10 December 2015

Scope of Work: Participate in a Planning Charrette to draft preliminary criteria related to permafrost degradation, erosion, and flooding for use in developing an initial village prioritization methodology that will serve as a guide in the allocation of federal and state funding for projects to protect existing infrastructure.

Participants: As mutually agreed to by the Commission and the Institute for Northern Engineering (INE).

Schedule: January 2016

Budget: Reimbursable at current published hourly direct rates for UAF staff. Indirect costs at the University's current approved indirect rate, plus travel and per diem expenses are authorized in accordance with 2CFR200.

Financial Assistance Award 1486
Between Denali Commission and University of Alaska - Fairbanks

Task Order #2

Statewide Threat Assessment Project
10 March 2017

BACKGROUND

In rural Alaska, there are billions of dollars of infrastructure at risk due to a variety of threats directly related to climate change. Based on prior studies by numerous State and Federal Agencies (see attached preliminary reference list) the Denali Commission has identified permafrost degradation, erosion, and flooding as the three primary environmental threats that directly impact infrastructure. Protecting rural Alaska infrastructure is particularly important because the survival of rural communities is so very dependent on facilities such as airports, clinics, power plant, bulk fuel storage, and water supply/waste disposal systems.

In 2009 the State of Alaska *Immediate Action Workgroup* published “Recommendations To The Governor’s Subcabinet on Climate Change”. One specific recommendation was to develop a methodology for the prioritization of need based on the risk to, among other things, infrastructure. Such a prioritization methodology would serve as a guide in the allocation of federal and state funding for projects to protect existing infrastructure. A charrette organized by the Denali Commission in January 2016 that involved experts from government, academia and the private sector confirmed that such a methodology would be useful. However, the charrette participants also determined that there are data gaps (primarily related to flooding and permafrost degradation) that need to be closed before a defensible methodology can be developed.

The goal of the Statewide Threat Assessment Project is to collect additional flood, permafrost and infrastructure data for rural Alaskan communities, analyze said data, and then develop a methodology that assigns a risk index for each threat for individual communities, as well as an overall aggregate risk index for all three threats when considered together. Among other things, these indices can then be used to determine which locations should logically be added to the current GAO list of 31 imminently threatened communities, at least in the context of the threat to infrastructure from permafrost degradation, erosion and flooding. Others may eventually expand the methodology to include additional climate change related threats to community resilience such as food source security, wildfires, dislocation/cultural issues, etc.

SCOPE OF WORK

This project is a collaborative effort between the University of Alaska – Fairbanks (UAF), the US Army Cold Regions Research and Engineering Laboratory (CRREL), and the US Army Corps of Engineers - Alaska District (USACE). USACE is responsible for identifying the risk from flooding and erosion. However, new work carried out by USACE will focus primarily upon flooding, because erosion was considered extensively in the 2009 Baseline Erosion Assessment (6). A copy of the USACE scope of work for the Statewide Threat Assessment Project is attached for reference. UAF, with assistance from CRREL, is responsible for evaluating the risk from thawing permafrost, as well as integrating the individual risks from coastal/riverine erosion, flooding, and permafrost degradation into a normalized, overall hazard index for each rural Alaska community with a year-round population greater than 20 (approximately 230 locations).

Permafrost risk as well as with the combined risk will result in an index similar to that presented in Hong, et al. (3). However, the regional maps provided in that manuscript were not developed at a resolution sufficient to evaluate individual communities. Those maps were based upon climate models and the permafrost characteristics observed over large physiographic regions, but did not consider the localized distribution of permafrost or type and placement of infrastructure within the communities. Consequently, UAF and CRREL will use multiple sources of existing information including geotechnical, images, published databases, and phone interviews. These data will be used to identify those communities that are underlain by permafrost, and to estimate the ice content of that permafrost. The ice content is critical to estimating thaw consolidation, which predicts the potential for damage to infrastructure.

Geotechnical data, satellite imagery, historical aerial photos, community profiles and other ancillary datasets will be used to identify which communities are founded on permafrost and which are not. Those communities with no or sporadic permafrost will be assumed to have negligible risk from thawing permafrost. Those communities located on discontinuous or continuous permafrost will be evaluated in more detail using the highest quality imagery available --- processed, corrected, etc. as necessary. Relevant climate, geological, road, stream, topographic, and infrastructure datasets will also be used as necessary for the more detailed analyses. As would be expected, those communities founded on warm, ice-rich permafrost are at a higher risk than those founded on cold, ice-poor permafrost. The philosophy of the analysis will be based on the potential for thaw consolidation resulting from the thawing of the permafrost.

The vulnerability of public infrastructure to thawing permafrost whether due to the structure itself or due to climate change is very much a function of the engineering of those structures. For example, structures with deep foundations are far less vulnerable than those founded on shallow foundations. Consequently, the vulnerability of infrastructure due to thawing permafrost will be combined with the engineering of the structure to assess the overall risk.

Infrastructure which is currently showing distress due to thawing permafrost will register a higher risk than those which may have anticipated damage far into the future. In order to determine this, a series of phone interviews will be conducted for those communities founded on permafrost.

Critical infrastructure for the purposes of this project/analysis includes health facilities, schools, power plants, bulk fuel storage facilities, water systems, wastewater systems, power distribution systems, telecommunication systems, airports, docks/harbors and major roadways. Factors to be considered include the value and vulnerability of existing infrastructure; vulnerability being assessed based on type of foundations and general temporal considerations.

The permafrost, erosion and flood data will be entered into a Geographic Information System (GIS) for future reference and to provide the ability to update data as new information becomes available. The system will be designed to allow for additional data sets which allows a more detailed analysis in the future. All data will be presented in a common format on a statewide interactive map so that individual communities can be queried for their general threat index for each specific threat.

UAF/CRREL Tasks

The UAF/CRREL scope is comprised of eight general tasks. While each task has responsible a person or persons, the entire team will provide support on each task.

Task 1: Determine Permafrost Characteristics for Each Community. Responsible Persons: Yuri Shur, Kevin Bjella, Andrew Balser and Misha Kanevskiy.

Make a determination on the existence of permafrost for each community. Based on an initial review of existing data by UAF, there appear to be approximately 100 communities in areas which do not contain permafrost or the permafrost is thaw stable with little or no potential for thaw consolidation. However, it is anticipated that 130 - 150 communities will need detailed evaluation, and that approximately 65 locations will have high permafrost hazard. Existing geotechnical data will be used to estimate the ice content and potential thaw consolidation resulting from thawing permafrost.

Task 2: Inventory and Estimate the Potential for Damage Due to Thawing Permafrost. Responsible Person: Il Sang Ahn

An inventory of existing public infrastructure will be developed for each permafrost community using existing databases and other available information. Based on that inventory, damage to critical facilities will be estimated based on the risk of thaw consolidation. Damage estimates will be qualitative based on the amount of movement required to cause cosmetic damage, functional damage and structural damage. These estimates will be based on experience rather than structural analysis.

Task 3: Inventory Existing Damage Due to Thawing Permafrost. Responsible Persons: Paul Perrault

Communities expected to experience damage due to thawing permafrost will be contacted to confirm the inventory developed in Task 2, and to determine if existing infrastructure is showing damage due to thawing permafrost. Other relevant/responsible organizations such as ANTHC, ADEC, ADOT&PF, and regional health corporations will also be contacted. Phone and/or other off-site interview techniques will be used to determine whether the damage is cosmetic, functional or structural.

Task 4: Develop Scoring Criteria for Permafrost Vulnerability. Responsible Persons: Billy Connor, Bill Schnabel, and Kevin Bjella

Using the data assembled in Tasks 1 – 3 a scoring criteria similar to Hong, et. al. will be developed and applied to each community in order to rank them with respect to damage due to thawing permafrost. The scoring will account for the presence of permafrost, the potential for thaw consolidation, existing damage and anticipated future damage.

Task 5: Combine Scoring From Erosion, Flooding and Permafrost Damage. Responsible Persons: Billy Connor and Bill Schnabel

Review erosion and flood data provided by USACE, draft scoring criteria developed by USACE for these two threats, and collaborate with USACE and the Denali Commission to develop a

normalized, aggregate risk index for all three threats when considered together. Consider using a weighted matrix approach to create the final score. For example, existing or near term damage may have a higher weight than damage anticipated well into the future. Frequent flooding events may have a higher weight than events that may be expected to occur once every one hundred years.

Assist the Denali Commission in presenting the draft threat assessment methodology at public meetings at 2 – 3 locations outside of Anchorage, and with other interested government stakeholders such as Alaska DCCED, DNR, DOT&PF, DEC, and USDA, USDOC, FAA, BIA before finalizing the methodology.

Task 6: Develop a GIS That Presents Data and Scoring. Responsible Person: Andrew Balser

Collaborate with USACE, the Commission and other stakeholders on how best to store and present the flood, erosion and permafrost data assembled during the project, and the resultant threat indices. At a minimum develop a query-able web-distributed data format (example Google Earth .kml file) that will present summary threat information for each community. Provide full GIS data (format suitable for download) to include the following information in a common format for the Denali Commission.

- Summary permafrost data (example: kml file(s) of village locations w tabular data)
- Detailed permafrost data (GeoDatabase, shape files, etc.) with provisions for flood* and erosion* data
- Supporting geospatial imagery (note that public re-distribution of high-resolution, commercial satellite imagery is restricted under U.S. Federal Law, and by the auspices of the NextView contract between the U.S. Government and commercial imagery providers; re-distribution determinations are made by U.S. National Geospatial Intelligence Agency).
- Vulnerability index for each specific threat*
- Aggregate vulnerability index*

** flood and erosion data, and corresponding threat indices, for each community will be developed by the U.S. Army Corps of Engineers Alaska District as complete, georeferenced vector and/or raster GIS datasets with metadata and a description of data development*

Task 7: Reporting Responsible Persons: Billy Connor, Bill Schnabel, and Kevin Bjella

Separate final reports will be prepared summarizing the work related to permafrost and the overall aggregate risk methodology. The permafrost report will describe the data, data sources, and interpretation of the data. It will also describe the scoring criteria for the permafrost index and results by community. The second report will summarize the methodology developed that combines all three threats. The report will also include a description of the GIS, layer structure, the data table associated with the GIS, and a summary of the knowledge/data gaps that should be addressed in future updates.

Task 8: Presentation Responsible Persons: Billy Conner and Bill Schnabel

A presentation of the final work products will be given at a mutually acceptable time and location to the Denali Commission.

DELIVERABLES

1. Permafrost Threat Index
2. Overall Threat Assessment Methodology
3. GIS Database with Web-Based Interface for Summary Data
4. Final Report

BUDGET

The total budget for this project is \$617,000. The UAF portion of the project budget is \$367,000 which includes UAF direct costs, the CRREL portion of the scope of work, and UAF indirect costs. The USACE Alaska District portion of the total project budget is \$250,000. More detailed budget information is summarized on page 6.

Costs for this project shall be paid on a reimbursable basis at current published hourly direct rates for UAF and other pre-approved sub-consultant staff. Indirect costs at the University's current indirect rate of 50.5% approved by the Office of Naval Research, plus travel and per diem expenses are authorized in accordance with 2CFR200. The budget on page 6 shall not be exceeded without prior written approval from the Denali Commission.

DELIVERY METHOD

UAF will perform their portion of the scope of work with a combination of in-house University professionals and staff at the Cold Regions Research and Engineering Lab (CRREL) Alaska Projects Office at Fort Wainwright. UAF will execute an appropriate sub-agreement with CRREL.

UAF is considered the lead entity on this project. A copy of the USACE Alaska District scope of work (dated 7 March 2017) related to erosion and flood data is attached for reference. This project does not include travel to individual communities or physical on-site surveys.

SCHEDULE

Key project milestones for this Task Order are summarized below.

- Task 1: October 2017
- Task 2: October 2017
- Task 3: November 2017
- Task 4: February 2018
- Task 5: March 2018
- Task 6: June 2018
- Task 7: June 2018
- Task 8: June 2018

Statewide Threat Assessment Project
Overall Budget Summary
10 March 2017

UAF Task Order #2 Budget

line	Item/Activity	By	Amount	Basis/Notes
1	Salaries and Benefits	UAF	\$140,000	1,730 hrs @ avg. rate of \$81/hr ¹ ; reference 25 May 2016 UAF-INE proposal
2		CRREL	\$135,000	945 hrs @ avg. rate of \$140/hr ² ; reference 25 April 2016 CRREL proposal
3	Travel ³	UAF	\$6,000	allowance
4	Indirect Costs ⁴	UAF	\$86,355	50.5% of lines 1, 3, and the first \$25,000 of line 2
5	Subtotal		\$367,355	
6	Total (Rounded)		\$367,000	Funded via Amendment 1 to Award 1486 between Denali Commission and UAF

Notes

1. \$122/hr with UAF indirect costs
2. Includes USACE/CRREL indirect costs
3. Coordination meetings in Anchorage and Task 5 trips to locations TBD (e.g. Bethel, Kotzebue)
4. The University of Alaska has a federally negotiated indirect rate of 50.5%

7	Budget for USACE - Alaska District Scope	\$250,000	Funded via Interagency Agreement between Denali Commission and USACE
8	Total Project Budget	\$617,000	

References

1. **Alaska Native Villages: Most Are Effected by Flooding and Erosion, but Few Qualify for Federal Assistance**, GAO Report 04-142, December 2003.
<http://www.gao.gov/products/GAO-04-142>
2. **Alaska Native Villages: Limited Progress Has Been Bade on Relocating Villages Threatened by Flooding and Erosion**, GAO Report 09-551, June 2009.
<http://www.gao.gov/products/GAO-09-551>
3. **Thaw Settlement Hazard of Permafrost Related to Climate Warming in Alaska**, Hong et al, 2013.
<https://accap.uaf.edu/?q=project/permafrost-settlement-caused-climate-warming-alaska-and-estimation-its-damage-costs-public>
<http://arctic.journalhosting.ucalgary.ca/arctic/index.php/arctic/article/download/4368/4372?body>
4. **How Much Might Climate Change Add to Future Costs for Public Infrastructure**, Institute of Social & Economic Research (ISER), June 2007
<http://www.iser.uaa.alaska.edu/Publications/Juneclimatefinal.pdf>
<http://www.iser.uaa.alaska.edu/Publications/JuneICICLE.pdf>
Replacement Cost for Public Infrastructure in Alaska: An Update. Foster & Goldsmith, ISER, 2008
http://www.iser.uaa.alaska.edu/Publications/webnote/Web_Note4a.pdf
5. **Alaska Permafrost Risk Application**, Ashley Seim, April 2016.
<http://rdi.maps.arcgis.com/home/item.html?id=81f315d5792c46f4a64bb08eff3cb31e>
6. **Alaska Baseline Erosion Assessment**, US Army Corps of Engineers, 2009.
<http://www.poa.usace.army.mil/Portals/34/docs/civilworks/BEA/AlaskaBaselineErosionAssessmentBEAMainReport.pdf>
Appendix A – Erosion Survey Results Summary
<http://www.poa.usace.army.mil/Portals/34/docs/civilworks/BEA/Appendix%20A%20-%20Erosion%20Survey%20Results%20Summary.pdf>
Appendix B – Criteria for Assessing Community Needs
<http://www.poa.usace.army.mil/Portals/34/docs/civilworks/BEA/Appendix%20B%20Criteria%20for%20Assessing%20Community%20Needs.pdf>

The remaining Appendices can be accessed from here:

<http://www.poa.usace.army.mil/Library/ReportsandStudies/AlaskaBaselineErosionAssessments.aspx>

7. **Waste Erosion Assessment and Review (WEAR)**, Alaska Department of Environmental Conservation, 2015

<http://dec.alaska.gov/eh/sw/WEARFinalReport/WEAR%20Final%20Report.pdf>

8. **Corps of Engineers Flood Database**

<http://mapping.alliedgis.com/>

9. **Recommendations To The Governor’s Subcabinet On Climate Change**, Immediate Action Workgroup, 2009.

10. **Risk Mapping, Assessment and Planning: Assisting Alaska Native Villages**, An Overview of FEMA’s Risk MAP Program, Sally Cox, State DCRA, February 2017.

Watershed Prioritization Methodology developed by URS (AECOM):

https://www.commerce.alaska.gov/web/Portals/4/pub/Alaska_RiskMap_Prioritization_Final_V2_2-9-12.xlsx

11. **Imperiled Community Water Resources Analysis**, Tetra Tech, 2010.

http://climatechange.alaska.gov/docs/iaw_tt_imperiled_h2o_30jun10.pdf

12. **Estimating Damages to Alaska Public Infrastructure From Climate Change**, Expert Meeting, September 24 – 25, 2015. International Arctic Research Center, University of Alaska - Fairbanks.

13. **National Infrastructure Protection Plan (NIPP) 2013 – Partnering for Critical Infrastructure Security and Resilience**, US Department of Homeland Security, 2013.

https://www.dhs.gov/sites/default/files/publications/NIPP%202013_Partnering%20for%20Critical%20Infrastructure%20Security%20and%20Resilience_508_0.pdf

14. **Climate Change and Stability of Urban Infrastructure in Russian Permafrost Regions: Prognostic Assessment Based on GCM Climate Projections**, Nikolay Shiklomanov, et. al., Geographical Review, January, 2017.

<http://onlinelibrary.wiley.com/doi/10.1111/gere.12214/full>

15. **Climate Change Damages to Alaska Public Infrastructure and the Economics of Proactive Adaptation**, April Melvin, et. al., Proceedings of the National Academy of Sciences (PNAS), January, 2017.

<http://www.pnas.org/content/114/2/E122>

Interagency Agreement 17FED1JAN17
Between Denali Commission and USACE – Alaska District

Task Order #2

Statewide Threat Assessment Project

7 March 2017

BACKGROUND

In rural Alaska, there are billions of dollars of infrastructure at risk due to a variety of threats directly related to climate change. Based on prior studies by numerous State and Federal Agencies (see preliminary reference list) the Denali Commission has identified permafrost degradation, erosion, and flooding as the three primary environmental threats that directly impact infrastructure. Protecting rural Alaska infrastructure is particularly important because the survival of rural communities is so very dependent on facilities such as airports, clinics, power plants, bulk fuel storage, and water supply/waste disposal systems.

In 2009 the State of Alaska *Immediate Action Workgroup* published “Recommendations To The Governor’s Subcabinet on Climate Change”. One specific recommendation was to develop a methodology for the prioritization of need based on the risk to, among other things, infrastructure. Such a prioritization methodology would serve as a guide in the allocation of federal and state funding for projects to protect existing infrastructure. A charrette organized by the Denali Commission in January 2016 that involved experts from government, academia and the private sector confirmed that such a methodology would be useful. However, the charrette participants also determined that there are data gaps (primarily related to flooding and permafrost degradation) that need to be closed before a defensible methodology can be developed.

The goal of the Statewide Threat Assessment Project is to collect additional flood, permafrost and infrastructure data for rural Alaskan communities, analyze said data, and then develop a methodology that assigns a risk index for each threat for individual communities, as well as an overall aggregate risk index for all three threats when considered together. Among other things, these indices can then be used to determine which locations should logically be added to the current GAO list of 31 imminently threatened communities, at least in the context of the threat to infrastructure from permafrost degradation, erosion and flooding. Others may eventually expand the methodology to include additional climate change related threats to community resilience such as food source security, wildfires, dislocation/cultural issues, etc.

SCOPE OF WORK

This project is a collaborative effort between the University of Alaska – Fairbanks (UAF), the US Army Cold Regions Research and Engineering Laboratory (CRREL), and the US Army Corps of Engineers - Alaska District (USACE). USACE is responsible for identifying the risk from flooding and erosion. UAF, with assistance from CRREL, is responsible for evaluating the risk from thawing permafrost, as well as integrating the individual risks from coastal/riverine erosion, flooding, and permafrost degradation into a normalized, overall hazard index for rural Alaska communities. A copy of the UAF/CRREL scope of work for the Statewide Threat Assessment Project is attached for reference.

USACE Tasks

USACE will assemble data on the location, frequency, and intensity of all known historical riverine and coastal flood events in the state of Alaska, and then develop a flood hazard index for individual communities. USACE will also review the *Alaska Baseline Erosion Assessment* they published in 2009, along with other more recently published erosion data, and then develop an erosion hazard index for individual communities. For the purposes of this project, USACE will consider all communities with a year-round population greater than 20.

Key personnel for flood and erosion data collection and analysis are Ken Eisses and Wendy Shaw.

Task 1: Flood Data

Assemble all existing riverine (rainfall, break-up/ice-jam, glacial outburst) and coastal flooding (storm surge and wave) frequency and intensity data for the state of Alaska from the following sources.

- a. USACE - Alaska District published Floodplain Data Sheets and High Water Mark Surveys
- b. Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS) Coastal Hazards Program
- c. National Weather Service – River Forecast Center (NWS-RFC) river break-up summaries and database

Develop Scoring Criteria for flood hazard/vulnerability. Produce a combined database and map for the entire state with spatially referenced NWS-RFC break-up floods, coastal floods, and USACE floodplain data. The database and map will be searchable by location, flood year, disaster declaration identifier, and flood hazard index. The floods will be color-coded by flood intensity based on current NWS-RFC designations of minor, moderate, or major flood.

Task 2: Erosion Data

Assemble all existing riverine and coastal erosion data for the state of Alaska from the following sources.

- a. 2009 USACE Alaska Baseline Erosion Assessment (ABEA)
- b. Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS) Coastal Hazards Program
- c. 2015 Alaska Department of Environmental Conservation (DEC) *Waste Erosion Assessment and Review (WEAR) Report*

Update ABEA Scoring Criteria for erosion hazard/vulnerability as appropriate. Produce a combined database and map for the entire state with erosion data. The database and map will be searchable by location, erosion hazard index, and disaster declaration identifier.

Task 3: Collaborate in the Development of an Aggregate Risk Index

Review draft permafrost scoring criteria provided by UAF and collaborate with UAF and the Denali Commission in the development of a normalized, aggregate risk index for all three threats (flooding, erosion, permafrost degradation) when considered together. Assist the Denali Commission in presenting the draft threat assessment methodology at public meetings at 2 – 3 locations outside of Anchorage, and with other interested government stakeholders such as Alaska DCCED, DNR, DOT&PF, DEC, and USDA, USDOC, FAA, BIA before finalizing the methodology.

Task 4: Reporting

Brief quarterly reports shall be uploaded to the Commission's Project Database. Separate final reports will be prepared summarizing the work completed for the flood and erosion data. The report will describe the data sources, final hazard/vulnerability scoring criteria, results by Community and the GIS databases established to house the information. The reports will also include a summary of the knowledge/data gaps that should be addressed in future updates.

DELIVERABLES

1. Flood Threat Index
2. Flood Database and Map
3. Erosion Threat Index
4. Erosion Database and Map
5. Final Reports

BUDGET

The total budget for this project is \$617,000. The UAF portion of the project budget is \$367,000 which includes UAF direct costs, the CRREL portion of the scope of work, and UAF indirect costs. The USACE Alaska District portion of the total project budget is \$250,000. A more detailed budget summary dated 7 March 2017 appears on page 5.

Costs for this project shall be paid on a reimbursable basis at current published hourly direct rates for USACE and other pre-approved sub-consultant staff. The budget on page 5 shall not be exceeded without prior written approval from the Denali Commission.

DELIVERY METHOD

USACE will perform their portion of the scope of work with a combination of professional in-house and contract personnel. USACE will coordinate with NWS-RFC staff as required to obtain all relevant riverine flood data.

UAF is considered the lead entity on this project. A copy of the UAF scope of work (dated 10 March 2017) related to permafrost degradation data and the development of an aggregate risk index is attached for reference. This project does not include travel to individual communities or physical on-site surveys.

SCHEDULE

Key project milestones for this Task Order are summarized below.

- Task 1: February 2018
- Task 2: February 2018
- Task 3: March 2018
- Task 4: June 2018